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Subject:	MDEQ Comments on Tittabawassee River Segments 4 and 5 Draft Response Proposal - Dow Chemical - MID 000 724 724
Attachments:	State of Michigan comments on ARAR provisions in Tittabawassee River Segments 4 and 5 Draft Response Proposal - Dow Chemical ; TR Trustees Seg4_5DraftRP Comments final.pdf

Michigan Department of Environmental Quality (DEQ) Review Comments on the Tittabawassee River Segment 4 and 5 (OU1) Draft Response Proposal – Revision 0
Settlement Agreement No. V-W-10-C-942 for the Tittabawassee River/Saginaw River & Bay Site
Dow Submittal Number: 2015.057

March 11, 2016

The DEQ has conducted a review of the Segments 4 and 5 Draft Response Proposal (RP4/5), which is dated December 18, 2015. Our comments are provided below.

The Michigan Department of Attorney General, has provided an addendum to this review that provides comments on the ARAR sections of RP4/5. This was provided in a separate e-mail dated March 4, 2016 and is attached for your convenience.

The DEQ is also incorporating the Natural Resource Damage Assessment Trustees comments on RP 4/5 by reference in this review (attached). Several comments are specifically referenced in the DEQ's review.

Thank you for the additional time to complete this review.

Please contact me if you have any questions regarding these comments.

Al

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Executive Summary

1) General. The Executive Summary needs to be clarified to indicate that the Response Proposal (RP4/5) does not address all of Dow's remedial obligations with respect to the banks and that further work to address other exposure pathways such as human direct contact and terrestrial ecologic risk will be conducted as part of the Floodplain Response Proposal and the Task 10 residual risk assessment(s).

2) Page ES-2. Paragraph 3. The DEQ has identified additional potential sediment management areas (SMA) during review of this document. If any of these SMAs are carried forward, this section will need to be revised.

3) Page ES-3. Paragraphs 1 and 2. As noted in previous comments on the Segment 2 and 3 Response Proposals and as noted later in these comments, the DEQ does not agree that the RAOs currently identified in RP4/5 are adequate. Further, the DEQ does not agree that monitored natural recovery (MNR) will achieve RAOs at the Segment 4 and 5 SMAs on a timeframe that is reasonable.

4) Section 1.2. - Comprehensive Site Wide Management Approach. The second to last sentence in this section needs to be clarified as follows (additional language in ***italic boldface***): ...for the purposes of reducing exposure to human and ecological receptors ***to acceptable levels.***

5) Section 2.2 – Physical Location and Features. Paragraph 1. The second to the last sentence in this paragraph should be clarified as follows (additional language in ***italic boldface***): This Segment 4 and 5 Response Proposal addresses in-channel and adjacent bank areas. ***In addition, the banks will also be evaluated for other relevant exposure pathways as part of the Tittabawassee River Floodplain Response Proposal and the Task 10 Residual Risk Assessment*** (or similar).

6) Section 2.4 - Source Control. This section should be expanded to identify when Dow stopped using the chloralkali process. In addition, Dow should provide a description of other dioxin producing processes and discharges in this section (e.g., 2,4,5-T, pentachlorophenol and other chlorophenolics production).

7) Section 2.5 - PCOI Distributions in the River. The duration of the period of direct discharge to the river is not known. It would be more accurate to state (additional/modified language in ***italic boldface***): ***Beginning with the direct discharge period in the early 1900's, the waste anode and cell body particles*** containing the PCOI contaminants mixed ....(or similar).

8) Section 2.6.1 - In Channel Geologic Stratigraphy. Page 9. This section should be clarified to indicate that glacial till does contain till sand units that can be extensive. These till sands are commonly used for as a potable water source in the study area.

9) Section 3.2 - Nature and Extent of Sediment Contamination - Composite Sampling. The DEQ has previously provided comments on this issue in review of the Segment 2 and 3 Response Proposals and these comments are incorporated by reference. These concerns were initially identified to Dow in the May 10, 2012, approval with modification document from EPA. As we have discussed in the technical meetings, the DEQ is open to working with Dow and U.S. EPA to continue to refine this methodology to improve its potential usefulness, especially for long term trend monitoring and to better understand surficial sediment TEQ concentrations. The Contaminated Sediment Technical Advisory Group (CSTAG) has also provided comments on this issue and is supportive of the use of incremental composite sampling and has made specific recommendations including "assess and optimize the compositing method and ensure consistent application of the optimized sample preparation procedures. The CSTAG also recommends the Region develop a decision tree that clearly bounds what level of duplicate analysis , divergence, or segment outliers are acceptable and when re-analysis is required."

It is noted that the 2015 sediment composite samples (not provided in the RP4/5) were built using a different and more sophisticated methodology that may help to address the high variability that has been observed in sample earlier replicate samples. Both the 2014 and 2015 results should be provided in the revised RP4/5 so that we can better understand how the change in compositing procedure has impacted replicate results.

10) Section 3.2.1 - In-Channel Sediment Primary Constituents of Interest (PCOIs)

a. Previously in the review of the response proposals for Segments 2 and 3, the DEQ has requested that Figures 3-2A and B and 3-3A -D be revised or supplemented with figures that show TEQ concentrations less than or equal to 100 parts per trillion (ppt) TEQ and greater than 100 ppt TEQ but less than or equal to 500 ppt. This would be helpful in the evaluation of Dow's proposed sediment management areas. Areas of sediment contamination that are present below 500 ppt TEQ may be significant in terms of remedial needs. The requested modifications were not made. As an alternative, Dow could expand the section to include a new table that lists the length weighted average TEQs (LWAs) for each of the cores and identifies the core intervals (length and TEQ) used to calculate the LWAs. In this way the Agencies would have ready access to the information (rather than piecing it together from a 1300 plus page PDF of data) and the agencies could spot check the calculated LWAs and verify that the length of core used is appropriate. **The MDEQ is requesting that the subject table be provided in the revised RP4/5.**

b. Please provide stationing for Figure 3-6.

c. This section should be augmented with a description/calculation of the uncertainty associated with the composite surface sample average concentrations and the surface weighted average concentrations presented for Segments 4 and 5.

11) Section 3.2.1 - In-Channel Sediment Primary Constituents of Interest.
What do the bedload sampling results show for this area? Why are these results not described in this RP3?

12) Section 3.2.2 - In-Channel Sediment Secondary Constituents of Interest (SCOIs). The agencies have previously commented on the SCOI screening process that Dow has used for Segments 2 and 3 and these concerns remain for Segments 4 - 7 (i.e., see Condition/Modification 4 of EPA's June 27, 2013, Approval Conditions/Modifications for the Tittabawassee River Segment 2 Response Proposal). The DEQ remains concerned that additional work may need to be done to address SCOIs after response activities have been completed on PCOIs. It is understood that Dow has provided the screening for Segment 4 and 5 in the Sediment and Bank Soil SCOI Screening for Segments 4 through 7 of Operable Unit 1 for the Tittabawasse River/Saginaw River and Bay Site (submitted December 15, 2015). The DEQ will be providing comments of the December 15, 2015 document separately; however, the following comments are being provided for consistency with comments previously provided by the DEQ on the Segments 2 and 3 Response Proposals:

a. It is not clear why a concentration of an SCOI must be detected at a frequency of greater than 5% (or greater than 1 time in bank soils) in order to be retained for further consideration. Because of the low number of cores relative to the size of the Segments, any detection should be evaluated against the appropriate ecological screening level benchmark (i.e. there are 37 in-channel cores that were analyzed for PCOIs over the 6.1 mile extent of Segments 4 and 5). Likewise, it does not make sense to require the detection to exceed background, the ecological screening level benchmark or a site-specific screening level, an equilibrium partitioning coefficient, or other published benchmark a frequency greater than 5% to be retained for further consideration. This type of process would be more appropriate for a spatially robust SCOI data set – which this is not. If a Dow related contaminant is detected, then it needs to be evaluated against the appropriate benchmark to determine if further work is required with respect to that contaminant. This is especially important due to the very limited sample density.

b. How are SCOI bioaccumulative chemicals of concern (BCCs) such as hexachlorobenzene being evaluated (e.g., the potential for low exposure/risk level (PLER) for chlorobenzenes does not address bioaccumulation)?

c. Does there need to be a way to evaluate other areas that did not have SCOI samples, but may have similar depositional characteristics as those where SCOIs were detected above benchmarks?

13) Section 3.2.3 – Core Log Review.

a. The text notes "oily/greasy" at II-787+00-IC983. This location appears to be a typo. Please correct.

b. It is not appropriate to conclude that there is no indication of "atypical sediment conditions" based on the text of this section. Analytical data for the SCOIs has not been collected from "oily/greasy" core location. Atypical conditions have been identified by core log review. Follow-up sampling and analysis at this location for SCOIs should be conducted to determine if additional work is necessary.

14) Section 3.3.1.1 – Nature and Extent of Bank Soil Contamination

a. Page 23 Last Paragraph. This paragraph indicates "…that shoreline and high surface/upland geomorphic units along the bank do not contain deposits of TEQ that are likely to be an erosional source to the river,…". This needs to be clarified. These deposits do contain deposits that could be a source to the river; however, they have not been prioritized for response because the thickness of the high TEQ deposits is small relative to the post-industrial levy deposits. Many of these shoreline and high surface deposits contain high surficial concentrations of TEQ that can, and probably do, erode into the river under certain circumstances. They just have not been prioritized for response actions as part of this response proposal.

15) Section 3.3.2.1 – PCOI Results from 2006 – 2014 Bank Soil Coring

a. Figures 3-8A – 8F need to be revised to show TEQ concentrations less than or equal to 250 ppt TEQ and greater than 250 ppt TEQ but less than or equal to 2000 ppt TEQ, consistent with the clean-up criteria identified in the Floodplain Response Proposal. The RP4/5 Bank TEQ Vertical Profile diagrams only show data above 500 ppt TEQ. Areas of bank contamination that are present below 500 ppt TEQ may be significant in terms of remedial and long-term monitoring needs and using the Floodplain Response Proposal clean-up criteria will assist in the overall site-wide management of bank soils.

b. Page 24. Paragraph 1. Dow states that "The bank LWA TEQ level was calculated to the bottom of the bank because TEQ levels below the bottom of the bank are not expected to be susceptible to erosion and a potential source to the river." More explanation is needed here. Why would such a deposit not be susceptible to erosion? If the TEQ deposit is below the bottom of the bank then it is in the river and may already be a source to the river. Clarification needs to be made that such deposits will be evaluated as potential SMAs. For example, Figure 3-8B show a core located near 780+00 that has about 5 feet of >10,000 ppt TEQ present below the "Approximate Bottom of Bank" line. This area needs further investigation.

c. General Comment. This section needs to be expanded to include a new table that lists the length weighted average TEQs (LWAs) for each of the bank cores and identifies the core intervals (length and TEQ) used to calculate the LWAs. In this way the Agencies would have ready access to the information (rather than piecing it together from a 1300 plus page PDF of data) and the agencies could spot check the calculated LWAs and verify that the length of core used is appropriate. **The MDEQ is requesting that the subject table be provided in the revised RP4/5.**

16) Section 3.3.2.3 - Comparison of Bank LWA and (Bank Face Composite) BFC PCOI Results. The BFC TEQ results are important in that they show the actual exposed concentration of bank soils that is eroding into the river. As noted in previous comments on this issue, the surface concentrations of TEQ in bank soils needs to be recognized as an important factor in determining what banks are prioritized for stabilization and what type of stabilization is proposed (i.e., for banks with high TEQ currently exposed at the surface, stabilization

technologies that include a barrier component may be more appropriate). In addition, this type of sampling could be used to evaluate high TEQ banks that are currently identified as "high" or "moderate" stability for prioritized monitoring or enhanced monitoring for possible future identification as BMAs. If the bank face concentration is high (i.e., the high concentrations are not buried) then they have a greater potential for actively providing TEQ to the river at more significant rates.

17) Section 3.3.3 and 3.3.3.1 - Bank Soil SCOIs and Evaluation of Bank Soil SCOIs

a. The agencies have previously commented on the SCOI screening process that Dow has used for Segments 2 and 3 and these concerns remain for Segments 4 - 7 (i.e., see Condition/Modification 4 of EPA's June 27, 2013, Approval Conditions/Modifications for the Tittabawassee River Segment 2 Response Proposal). The DEQ remains concerned that additional work may need to be done to address SCOIs after response activities have been completed on PCOIs. It is understood that Dow has provided the screening for Segment 4 and 5 in the Sediment and Bank Soil SCOI Screening for Segments 4 through 7 of Operable Unit 1 for the Tittabawasse River/Saginaw River and Bay Site (submitted December 15, 2015). The DEQ will be providing comments of the December 15, 2015, document separately.

18) Section 3.4.2 - Bed Pin Analysis

a. The 2015 bed pin data for Segments 4 and 5 need to be included on the Appendix C3 cross sections.

b. The presented bed in-channel cross sections demonstrate an active bed depth of greater than 2 feet in a number of locations in Segments 4 and 5.

c. There are a number of locations where additional bed pin transects may be appropriate to evaluation high TEQ deposits that have not currently been identified as SMAs. For example, the deposit present at the JJ/KK boundary (not currently identified as an SMA) does not have an associated bed pin transect. Consideration should be given to how these deposits will be monitored in the future.

d. During our recent technical meetings and review of the 2014 Annual Report (received in December of 2015) it was reported by Dow that some bed pin transects had been removed from service. This is not acceptable without prior agency approval. In some cases the bed pins will be necessary to continue to verify the stability of deposits that have not been removed or capped.

19) Section 3.5 - Biological Conditions. The DEQ requests that EPA specifically incorporate the Natural Resource Damage Assessment Trustee Comments on this Section into this review.

20) Section 3.6.3 – Identification of Historic or Culturally Significant Resources. The DEQ requests that EPA specifically incorporate the Natural Resource Damage Assessment Trustee Comments on this Section into this review.

21) Section - 3.7.2 Direct Contact Ecological Receptors

a. Page 35. Last paragraph. The RP4/4 text indicates that the SCOI data set is spatially comprehensive. This is a bit of an overstatement. The data set may be adequate to identify responses. Additional data collection may be necessary for residual risk assessment.

b. Please see earlier comments on SCOI screening process. Additional work is necessary with respect to this issue.

22) Section 3.7.3 - Bioaccumulation and Potential Food Web Exposures. Please see earlier comment on bioaccumulation with respect to SCOIs (e.g, hexachlorobenzene).

23) Section 3.8.1 - Identification of SMA Locations in Segments 4 and 5

a. Dow needs to provide additional information on the multiple lines of evidence cited for the identification of a SMA. What criteria were used to identify a "contiguous deposit of elevated concentration of TEQ."

   i. What concentration is considered elevated?

   ii. What constitutes a contiguous deposit?

   iii. How are the TEQ composite sample results factored into the evaluation?

b. Dow needs to provide an evaluation of all elevated TEQ areas to show why they do not need to be SMAs. The DEQ agrees that the two SMAs currently identified are SMAs; however, a full evaluation of the other potential SMAs needs to be included as part of the RP 4/5. The provision of the LWA core data for each of the in-channel cores (comment 10 above) will be helpful in this evaluation. At this point Dow has not made a credible case that only SMAs 5-1 and 5-2 need to be addressed in the RP4/5. In addition, it is important to document the basis of the decision to include or exclude deposits from active remediation. The RP4/5 needs to be expanded to include this information.

24) Section 3.8.1 – Identification of SMA Locations in Segments 4 and 5. Page 34. Paragraphs 3 and 4.

a. It appears that Dow is attempting to establish 10,000 ppt TEQ as a base criteria for the establishment of an SMA. As noted in previous comments, the 10,000 ppt TEQ level was established as an Interim Response Activity level to determine if early action was needed to control short term transport risk. The 10,000 ppt TEQ interim response value in not a final cleanup criterion and concentrations in TEQ deposits well below 10,000 ppt TEQ need to be evaluated to determine the need to perform active response activities.

b. The description of the bed stability in middle Reach II is inaccurate and needs to be revised:

   i. The statement "…and bed pin measurements within the SMA boundary show minimal change in the sediment bed elevation between monitoring events…" is not relevant to the question of bed stability over the long term. The important measure is the overall change in the bed depth over time, not between monitoring events. We are concerned with the loss of the deposit over the long term – not just between monitoring events.

   ii. Bed pin transect 783+00, which is squarely within the proposed SMA, shows up to 4.2 feet of change in bed depth at and proximal to the proposed SMA. The bed depth in this area is quite active and this needs to be considered in the evaluation of remedial alternatives for this SMA.

c. Likewise, the description of bed stability in upper KK indicates that the deposit is located 1 foot below the sediment surface. Bed pin analysis in this area show over 1 foot of change in bed elevation over the period when measurements have been taken. The active bed appears to impinge on the deposit.

25) Section 3.8.2.3 – Other Areas of Interest in Segment 4 and 5.

a. Page 35. Paragraph 4. The last sentence in this paragraph which states "…do not represent a contiguous deposit of elevated TEQ," is inaccurate and needs revision. The data indicate a small but elevated TEQ deposit. The analysis should also note where in the cores the TEQ is elevated. It is noted that there are no bed pins located at this deposit and this should be considered for future monitoring.

b. As noted in earlier comments, a specific evaluation of each potential SMA needs to be provided in RP4/5 for review and to document the status of these deposits for the administrative record and future monitoring

c. Potential SMAs that require analysis/evaluation/documentation include elevated TEQ areas at or around:

   i. 670+00

   ii. 705 +00

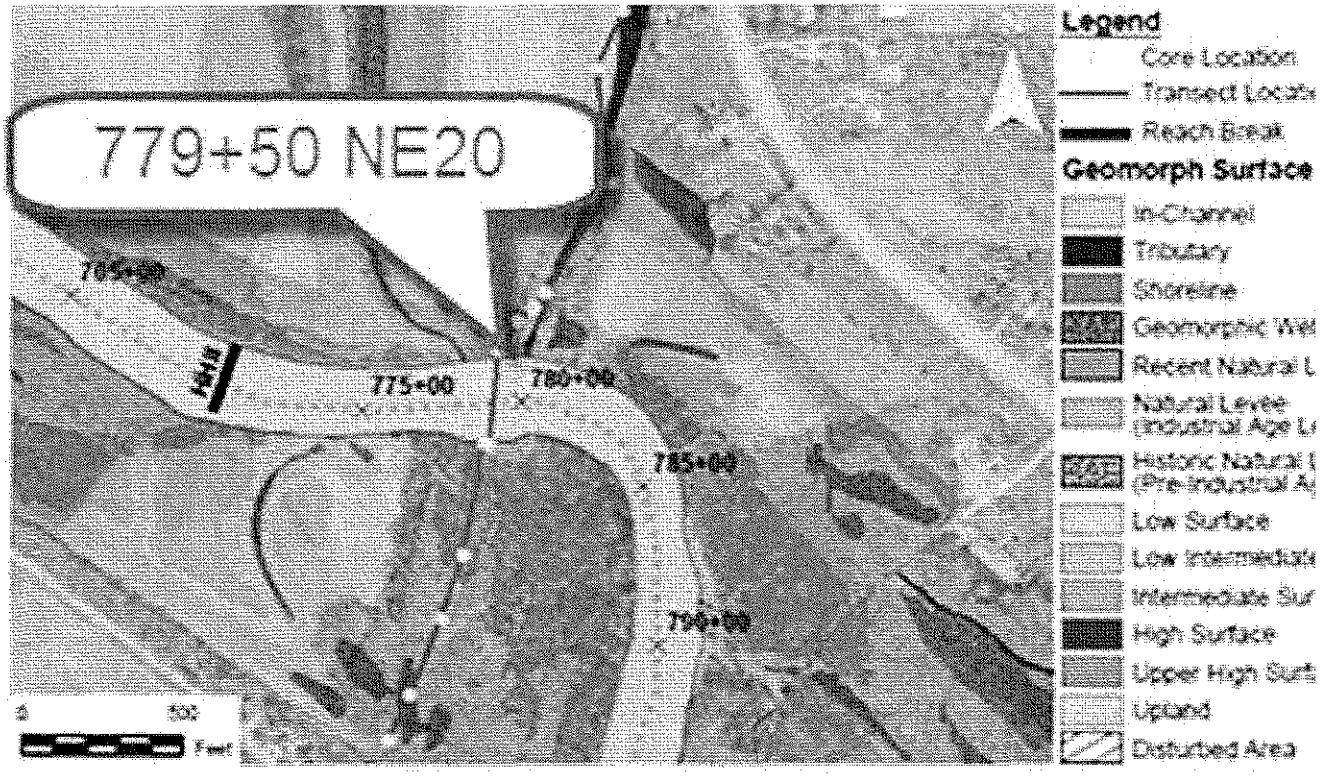
   iii. 720 +00

   iv. 771 +00

   v. 802 +00 (note: this is of particular concern due to high TEQ levels and a dynamic sediment bed depth as demonstrated by bed pin data – changes in bed depth up to 5 feet).

   Again, the provision of the table of LWAs/core length/sample length and TEQ will greatly facilitate this review (Comment 10).

d. The RP3 and RP4/5 indicate that certain geomorphic shoreline deposits are being screened out in the bank evaluation process because they were not likely to erode as bank soils (i.e., they behave more as sediment deposits). The chemistry data from these shoreline deposits and bank levy deposits that are present below the waterline need to be included for evaluation with any contiguous in-channel data to verify that there are no additional near shore SMAs that require remedy. In some cases it may be appropriate to collect additional in-channel data to determine if bank deposits that extend below the waterline represent potential nearshore SMA deposits. For example, a northeast bank core at approximately 779 + 50 shows five feet of core with TEQ concentrations greater than 10,000 ppt below the water surface. In channel cores should be taken adjacent to and downstream of this feature to determine if the levy deposit material is "daylighting" in the river bottom at elevated concentrations. See figure below:


779+50 NE20
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Geomorph Surface
In-Channel
Tributary
Shoreline
Geomorphic Wet
Recent Natural L
Natural Levee
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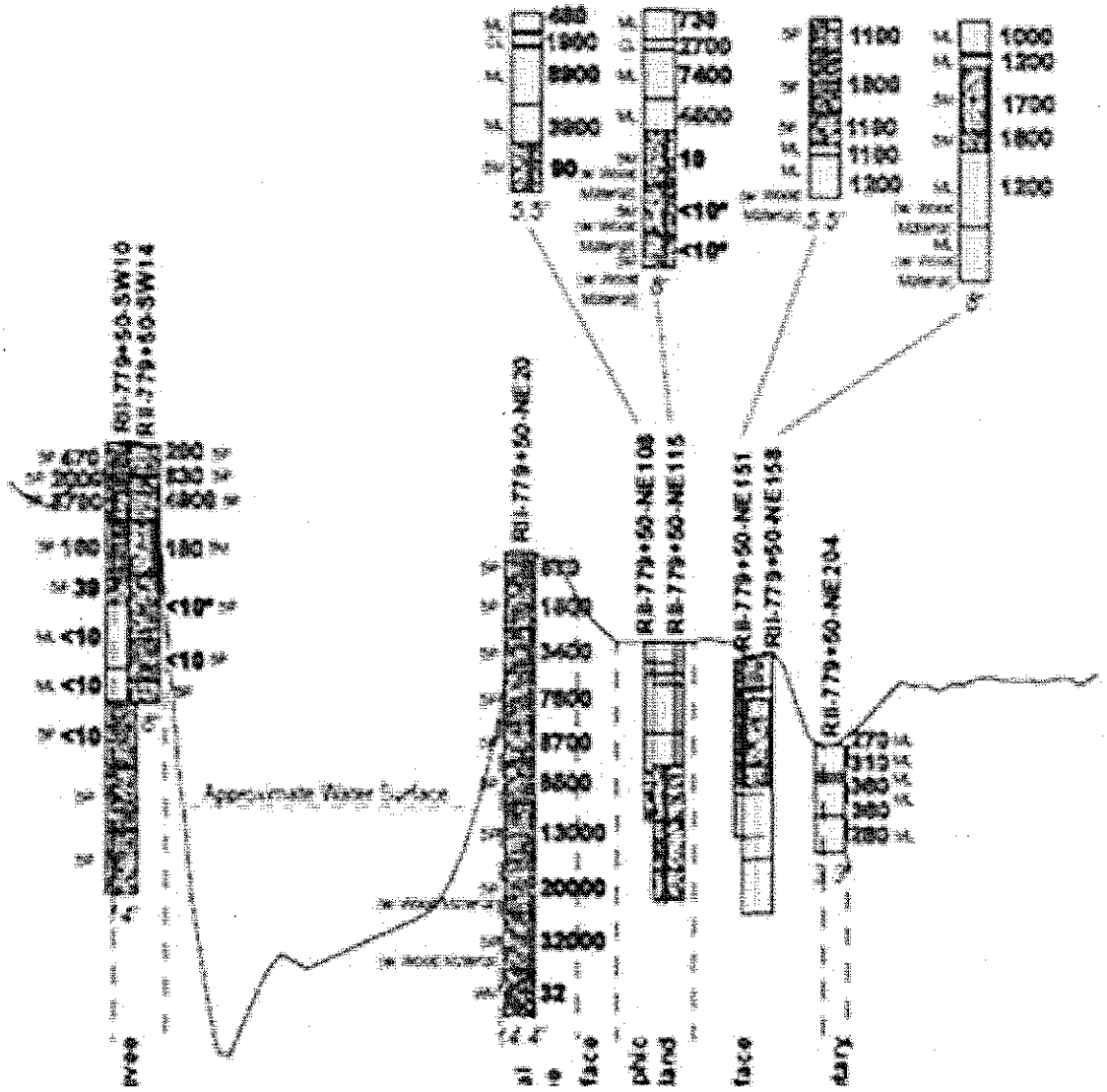
Historic Natural L
(Pre-Industrial A
Low Surface
Low Intermediate
Intermediate Sur
High Surface
Upper High Surf
Upland
Disturbed Area
0
500
Feet


RII-779+50-SW10
RII-779+50-SW14
RII-779+50-NE20
RII-779+50-NE108
RII-779+50-NE115
RII-779+50-NE151
RII-779+50-NE158
RII-779+50-NE204
Approximate Water Surface

26) Section 3.9 – Bank Management Areas. General.

a. Figures 3-8 A-F should be revised to depict concentrations beginning at 250 ppt TEQ or less, and include a less than 2000 ppt TEQ interval so they can be more easily integrated with the Floodplain Response Proposal.

b. The DEQ recommends changing the wording for "bank stability" in this section and on Figure 3-15 to "***current*** bank stability" to reflect that the initial evaluation is at a point in time and that ongoing evaluation of the stability of high TEQ bank deposits will be necessary in a dynamic river system where banks are expected to move naturally.

27) Figure 3-15. Segment 2 Bank Management Area Prioritization Flow Diagram.

a. The following lines of evidence need to be incorporated into the lines of evidence used to evaluate current bank stability in the Segment 3 response proposal:

i. Historic Air Photo Evaluation. It is recognized that there is some uncertainty in the evaluation of historic air photos; however, this level of uncertainty is certainly no greater than the uncertainty in predicted rates of bank erosion (see Appendix D1 of the Segment 2 Response Proposal). The information provided in Figure 2-4 (Historic Segment 4 and 5 Channel Boundary) should be reviewed against banks with prioritized levels of TEQ to better understand long term erosion risks to TEQ deposits. This also can serve as a check on the model predicted erosion rates.

ii. Evidence of Mass Wasting (e.g., at risk or drunken trees, slump blocks, fresh scarp faces, etc.). The presence of large scale erosion features is a clear indication of bank instability and needs to be included as a line of evidence in the stability evaluation.

b. A pathway on the flow diagram needs to be added that provides for additional evaluation of currently identified moderate- to high-stability banks with elevated TEQ (initially prioritized TEQ deposit or uncertain TEQ deposit) to determine if high TEQ concentrations are present at or near the banks' surfaces (see Bank Face Composite Sampling comment above). If so, these banks should be retained as BMAs (or require more intense monitoring) because the high TEQ is already present at the surface and even relatively low amounts of erosion could present a problem. The presence of high TEQ at the surface also indicates that the river has already eroded into the levee deposit and may continue to do so without further action. Focusing on banks that are currently and actively contributing to the TEQ loading to the river will result in greater remedial effectiveness in the short- and long-term. Initially prioritized TEQ deposits that are stable and do not have high surface concentrations of TEQ would continue to be monitored for stability.

c. Two of the "green diamonds" on Figure 3 -15 need some revision. These state: "Does the bank contain a high-priority TEQ deposit that could be a source to the channel sediments?" and "Does the bank contain a high-priority TEQ deposit that could be a source to the channel sediments?" This wording indicates that the banks are not currently a source, which is not correct (e.g., moderate to high stability banks have modeled erosion rates of less than 2.5 inches per year). These banks are a source to sediments – they are just not a source that has been prioritized for active remediation at this time.

28) Section 3.9.1 Banks in Hardened Surface Areas. Representative photos of each of the banks being excluded from evaluation need to be provided. There are a wide range of bank hardening treatments and some are more effective than others. In addition, high TEQ banks need to be identified and tracked/monitored – even if they are in hardened banks. Bank failures occur and modifications to bank treatments occur. The RP4/5 needs to identify any high TEQ or potentially high TEQ banks that have been excluded based on hardened surface areas.

29) Section 3.9.2 Banks with Shoreline or Upland/High Surface Geomorphological Features. If the "shoreline geomorphic units" are not evaluated as part of the BMA determination process, and they contain elevated concentrations of TEQ, then they need to be included as part of the SMA evaluation (see comment above). In addition, it should be noted that these features will be addressed, as necessary as part of the Floodplain Response proposal.

30) Section 3.9.3 - Bank Stability Evaluation.

a. It is not clear why Dow did not use bank pin and tree root data directly in the bank evaluation process. Where present, these empirical lines of evidence need to be compared to model-predicted erosion rates to validate determinations of bank stability – especially when those banks are prioritized TEQ deposits that may need remedial action. The bank model erosion rate "line of evidence" is a model prediction. When that prediction does not match the empirical "lines of evidence" then the model output is suspect for that location. Other erosion factors that are not considered by the model such as bank failure, freeze/thaw, ice scraping, etc. may be locally important and are not addressed by the bank full fluvial entrainment model. In addition, erosion does occur under non-bank full conditions.

b. The Agencies need to retain the ability to objectively overrule determinations of bank stability when those determinations do not appear to reflect reality in the field.

c. This section needs to better describe or reference the methodologies use to determine undercutting, bank angles, level of exposed roots, level of vegetative cover, etc.

d. Where does the bank stability evaluation data reside? The Agencies should have access to this data to spot check the evaluations/maps as part of the response proposal review process.

31) Section 3.9.3.6 – Model Predicted Bank Erosion Rate.

a. The calculated rate appears to reflect an average rate over the entire bank full bank face within a 300 foot grid cell. Therefore, the model predictions need to be evaluated cautiously as the averaging process may mask local areas of erosion that may be significant.

b. The rationale for selecting a 2.5 inch per year erosion rate as the threshold between high/moderate stability and low stability is not clear. Over two feet of erosion in ten years does not seem to be "stable" – especially with respect to contamination that is near or at the bank face.

c. While the modeled magnitude of the erosion rate is useful for prioritizing the banks for action, Michigan is not "approving" a modeled loss to the river of contaminated bank soil at less than 2.5 inches per year as being acceptable.

32) Section 3.9.4 – Evaluation of Bank TEQ

a. The Relative TEQ Index for Segments 2 – 7 needs to be provided as an Appendix to the RP. This should include the locations of each of the banks included in the Index, the length of the bank and the TEQ value used to represent the bank segment. This is an important part of the administrative record (it is used to prioritize banks for remedial activities) and it has not been provided.

b. As stated in previous comments, soils below the bottom of the bank are potentially susceptible to erosion and need to be evaluated as a potential SMA if they are being excluded from the BMA evaluation. For example, see northeast bank core 779+50-NE20 (embedded figure above).

33) Section 3.9.5 – Results of the Segments 4 and 5 BMA Evaluation.

a. Additional text needs to be added to this section to indicate that additional BMAs may be identified based on the results of trend monitoring and/or post remedial risk assessment (or similar).

b. The DEQ agrees with the BMAs that have been currently identified and reserves the right to recommend additional BMAs based on evaluation of the requested table that contains the LWA bank core information, the Relative TEQ Index for Segments 2 – 7, field evaluation of banks not currently identified, etc.

c. Page 44. First bullet. The phrase "no further action" needs to be removed from this bullet. The revised bullet should read: "Intermediate TEQ index banks to be evaluated to determine whether monitoring or a response action is warranted." The phrase "no further action" is not correct because it is not known if addressing only the currently prioritized high an intermediate TEQ banks will be sufficient to meet remedial objectives.

d. Page 44. Third bullet. This paragraph should be clarified as follows (additional language in ***italic boldface***): Banks where no response actions are ***currently*** proposed.

e. Page 44. Last paragraph. An additional sentence should be added that states: Proposed changes to the number, location, extent of Segment 4 and 5 BMAs will be documented in a supplemental technical memorandum(s) that will be submitted to the Agencies for review and approval (or similar).

34) Section 4.1 – Segments 4 and 5 Conceptual Site Model and Basis for Action.

a. Pages 46 and 47 and Figure 4-1. Neither Figure 4-1 nor the text addresses the pathway of floodplain soils eroding back into in-channel sediments. The magnitude and significance of this pathway is not currently known.

a. Page 46. Third paragraph. The sentence: "During the period of primary PCOI release (c.a. 1900 and for several decades thereafter)..." is inaccurate and needs to be revised. Primary PCOIs continued to be released to the river later in the operational history of Dow – presumably at lower rates than when materials were directly discharged to the river. The sentence needs to be reworded to "During the period when PCOIs were directly discharged to the river (c. a. 1900 and for several decades thereafter)..." or similar.

b. Page 46. Last Paragraph. This text should be revised to reflect that fish also accumulate PCOIs through respiration of water (both fine particles suspended in water column and dissolved phase PCOIs).

c. Page 46. Last Paragraph. This text indicates that the PCBs are not site-related. This does not appear to be a factual statement and needs to be removed or revised for accuracy. DEQ and Dow sampling of DNAPL in 2011 and 2012 from several of the Segment 1 SMAs has shown the presence of coplanar (dioxin-like) PCBs at significant TEQ levels.

35) Section 4.2.1 - Remedial Action Objectives – Note - these comments have been made previously to EPA in review of the Response Proposals for Segments 2 and 3.

a. RAO 1 General Response Objective
As currently written, the RAO 1 General Response Objective in the RP is "Reduce potential transport of TEQ-impacted media that may contribute to increased surface-sediment TEQ levels in/or downstream of Segments 4 and 5." The associated performance objectives are to "Reduce TEQ contributions from potentially significantly eroding bank deposits/in-channel deposits to the to the sediment surface. "

These are not specific enough and needs to be expanded and clarified to be consistent with Paragraph 8.3.1 of the AOC Statement of Work (SOW)) which indicates that the "objectives shall focus on reducing

exposures to and transport of contaminated media for purposes of achieving acceptable levels of human health and ecological risks." The reductions need to be tied to achieving acceptable risk levels. As currently written, it could be argued that *any* reduction would meet the RAO over any timeframe.

b. Page 47. RAO 1 General Response Objective
As currently written, the RAO 2 General Response Objective in the RP is "Reduce Segments 4 and 5 contributions to TEQ levels in OU1 fish tissue." The associated performance objective is to "Conduct and/or maintain response actions that contribute to reduced fish exposures to surface sediment TEQ."

Again, these do not appear to be specific enough and need to be tied to achieving acceptable risk levels over a reasonable time frame.

c. The RP needs to include discussion of how the other General Response Objectives that are identified in Paragraph 8.3.1 of the SOW will be addressed – either under this response proposal or under the Floodplain Response Proposal.

These other SOW General Response Objectives (that are not specifically identified in the RP) include but are not limited to reducing current or potential unacceptable human health risks associated with direct and indirect exposures to contaminated sediments, banks and floodplain soils; and consumption of contaminated wild game. For ecological risk the general response objectives include reducing current or potential future unacceptable risk to ecological receptors associated with contaminated media or food chain exposures.

36) Section 4.2 - Measurable Metrics. Dow has identified four metrics with no background or discussion. Discussion on how this metrics would be accurately measured, evaluated, and related to the identified POs needs to be provided. Other metrics may be necessary to meet the requirements of the SOW (e.g., chemical monitoring of the floodplain to empirically show that concentrations ofTEQ moving to the floodplain are being reduced to acceptable levels on an agreed to time frame; measured erosion rates via bank pins, measurement of establishment of vegetation, periodic measurement of bank face TEQ concentrations, etc.).

37) Section 4.3 - Applicable or Relevant and Appropriate Requirements. ARAR comments were provided on March 4, 2016, as described in the introductory note to these comments.

a. General comment. With respect to chemical specific ARARs, it is important to note that the DEQ has determined that in order for Dow to meet their corrective action obligations under Michigan law and their Hazardous Management Facility Waste Operating License (License), Dow will need to meet the performance based risk standards identified in Part 201, Environmental Remediation, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). Michigan's risk range is narrower (maybe more stringent) than EPA's and specifies a ceiling cancer risk level of 1 in 100,000 and/or a Hazard Index of 1 (MCL 324.20120a (4)) for individual properties/exposure units along the Tittabawassee River. Therefore, the DEQ is retaining Part 201 as a chemical-specific ARAR that is potentially applicable. This ARAR is potentially applicable to chemical monitoring conducted as part of the measureable metrics, setting the performance standard for the Task 10 risk assessment, soil relocation, and meeting Dow's corrective action obligations under their Part 111 License.

38) Section 5 – General

b. Third Bullet. This bullet indicates that "…no long-term bank monitoring or management of the SMAs would be required after sediment removal" should be clarified with the addition of "***if the high TEQ deposit is removed***," or similar. If a high SMA is only partially removed and high TEQ sediments remain, then addition long term obligations will persist.

c. Fourth Bullet. This bullet should be clarified to indicate that in some cases bank soils will be removed and disposed of in order to achieve an appropriate bank angle for stabilization, or similar.

d. Fifth Bullet. The last sentence indicates that "no long-term bank monitoring or management would be required under this option" should be clarified with the addition of "***if the high TEQ deposit is removed***," or similar. If a high TEQ bank is only partially removed and high TEQ soils remain, then addition long term obligations will persist.

39) Section 5.1.1 – Monitored Natural Recovery (MNR)

a. Page S7. Paragraph 1. As noted in previous comments provided by the DEQ on Segment 2, the TEQ transport model and predictions made from this model are suspect and should not be relied upon.

b. Page S7. As noted in earlier comments, SMA 5-1 and 5-2 bed pin (and bathymetric data) shows that these deposits are currently vulnerable to active erosion and are not good candidates for MNR. The text of this section should be revised accordingly.

c. Page 57. Fifth paragraph. The text indicates that: "A key determinant of the effectiveness of MNR within a given SMA is sediment bed stability, which is related to the dynamic equilibrium of the bed over annual time scales..." This statement ignores the importance of episodic events that can cause the deposit to be lost. As noted previously, the active bed depth as determined by bed pin analysis shows that the deposits at SMA 5-1 and 5-2 are at risk of loss without removal and/or capping.

40) Section 5 - Segments 4 and 5 Response Technology Descriptions. This section should be augmented with a discussion of a combination of containment and removal technologies given the river access and water depth issues that Dow has described in the Technical Meetings.

41) Section 5.1.2 – In Situ Containment – Natural Deposition/Cellular Containment Systems and Armored Caps. The DEQ does not support the "greater than 4 ft." rule of thumb that Dow appears to be proposing here. Even if the river bed is currently stable in a particular area of the river (which it is not at SMA 5-1), existing monitoring systems show that greater than four feet of river bottom change occurs in this river system. More discussion and adequate technical support for this concept would need to be provided by Dow before the DEQ would consider this type of proposal.

42) Section 5.1.3 – Removal. As noted above, the DEQ does not support the "greater than 4 ft. rule of thumb" as a maximum dredge depth. In particular, This could actually make a situation worse by exposing highly contaminated materials at the river bottom resulting in contaminant loss and increased exposure potential. More discussion and adequate technical support for this concept would need to be provided by Dow before the DEQ would consider this type of proposal.

43) Section S.2 - BMA Response Alternatives

a. This section correctly notes that the specific remedial technologies and process options most appropriate for BMAs depends on a number of location-specific issues. This list should be expanded to include the bank surface concentrations of PCOIs.

b. General. It may be prudent to include a capping/cover component to the stabilization actions in the RP4/5 in order to provide Dow with the flexibility to address the potential for exposure pathways other that erosion to the river (i.e., direct contact with high concentration surficial soils).

c. Does this section need to include some description of how high TEQ banks that have not been initially prioritized as BMAs for remedy will be monitored to determine if additional action will be necessary in the future? How is this concept addressed in the overall Response Proposal?

d. Chemical monitoring/additional bank surface TEQ characterization may be necessary to determine if other exposure pathways are relevant on the banks.

44) Section 5.2.2 – Removal. This section should be expanded to include discussion of additional components such as bank stabilization and monitoring in the event that the removal option does not address all of the high TEQ bank soil materials.

45) Section 6.1.1 – Effectiveness

a. General. There should be some discussion in this section on how effectiveness criteria will be met (overall protection of human health and the environment) by addressing other potentially significant exposure pathways for bank contamination as part of the Floodplain Response Proposal (e.g., direct human contact, ecological risk, etc.).

b. Overall Protection of Human Health and the Environment. As noted previously, the RAOs cited in this section need to be revised to be more consistent with the requirements of the SOW.

c. Effectiveness Evaluation. As noted in earlier comments, the referenced RAOs need to be strengthened to be consistent with the requirements of the SOW by adding a temporal and spatial component and specifying that acceptable levels of risk will be met.

46) Section 6.2 – Common Elements

a. Page 65. Third Bullet. Hydraulic Assessment. This bullet needs to be revised to change to indicate that a hydraulic assessment ***will*** be performed to determine whether the Segments 4 and 5 actions have the potential to affect flooding elevations.

b. Page 65. Sixth Bullet. Operations and Maintenance. This bullet needs to be revised to indicate that partial removals may also be subject to operations and maintenance.

47) Section 6.3 – SMA Alternatives Evaluation. As noted above, the Dow would have to provide substantial additional evaluation and support for DEQ to consider a partial removal to a maximum depth of four feet.

48) Section 6.3.1.1 – Overall Protection of Human Health and the Environment.

a. Alternative 1 (MNR). Paragraph 2 indicates that "the bed overlying the majority of the SMA 5-1 (downstream of 782 +00) is stable." This is not accurate. Figure B3-14 shows Bed Pin Transect RII-785+00. This figure shows elevation changes of up to 4.2 feet within the footprint of the SMA. The instability of the active be indicates that MNR is not an effective alternative for SMA 5-1.

b. Alternative 1 (MNR). Page 67. Paragraph 3. The information provided in the RP4/5 do not support the statement "...buried SMA TEQ deposits have a relatively low likelihood of being eroded and transported downstream..." The bed pin data shows up to 1.2 feet of change over the time monitoring has been conducted. Some portions of SMA-2 have only a foot of relatively cleaner material over the high TEQ deposit. The shallow nature of the high TEQ deposit and the greater than one foot active bed make MNR a poor alternative for this deposit.

c. Alternative 1 (MNR). Page 67. Paragraph 3. The statement that "...ensuring transport pathways remain broken" is not supported by the RP. Review of the sediment cores and the bed pin data shows that the contaminated materials are present at or within the active bed depths of the currently identified SMAs.

d. Alternative 2 (In Situ Containment). Page 67.

i. The word "further" needs to be removed from the phrase "further isolating sediment contaminants from human and ecological receptors." See comment above.

ii. Alternative 2 (In Situ Containment). Page 67. The phrase "...and establish a new sediment surface overlying the SMA," needs to be changed to establish a "***clean***" sediment surface overlying the SMA.

e. Alternative 3 (Removal). Page 68. Paragraph 1. Last Sentence. This sentence states that "the need for a post removal residual sand cover would be determined at the time of construction or based on further sediment transport assessments." This needs to be modified to indicate that the need for a residual sand cover will be determined during remedy design, or similar.

49) Section 6.3.1.2 – Compliance with ARARs. Alternative 2 (In Situ Containment) and Alternative 4 identifies a 0.1 foot limit mandated by the Michigan Floodplain Act. This has been reviewed by DEQ Water Resources Division staff and determined to be incorrect. No increase is allowed under the Act.

50) Section 6.3.1.4 – Short-term Effectiveness. Alternative 2 (In Situ Containment). Page 69. This section should be augmented with a discussion of short-term construction impacts related to site access for armored cap placement (roads, heavy equipment, etc.).

51) Section 6.3.1.5 – Long-term Effectiveness and Permanence. Page 72. Alternative 1 (MNR). MNR has not been demonstrated to be effective on an acceptable timescale in the absence of additional secondary source controls, even decades after primary source controls have been implemented at the Dow Plant site. Other items that are not discussed include:

a. Institutional controls would also be necessary to restrict dredging/bottom disturbance at SMAs (i.e. prop wash, restrictions on dredging, etc.)

b. Changes in river morphology that could alter the course of the main channel and erode SMA deposits.

c. Risk of deposit loss.

52) Section 6.3.1.5 - Long-term Effectiveness and Permanence. Page 72. Alternative 2 (In Situ Containment). One consideration that needs to be evaluated in the selection of a remedy for the SMAs is that the material trapped by a CCS cap may have relatively high TEQ concentrations. Figure 3-6 (Segments 4 and 5 TEQ Composite Sample Results) indicate composite results of about 700 ppt TEQ for the SMA 5-1 area and 880 ppt TEQ for the SMA 5-2 areas.

53) Section 6.3.2 – Implementability. Alternative 3 (Removal) and Alternative 4 (Combination of In Situ Containment and Removal). As noted previously, it is not clear that a maximum removal depth of four feet will be adequate to meet remedial objectives.

54) Section 6.3.3 - Cost. Page 77. Dow has estimated the 30 year cost of MNA monitoring over 30 years at an individual SMA to be $28,000 (or less than $1,000 a year). This seems to be quite low – especially if chemical monitoring is required to document the effectiveness of MNA.

55) Section 6.4 - BMA Alternatives Evaluation. Page 78. This section lists "Key BMA Characteristics." This section needs to be expanded to include consideration of the TEQ concentration at the surface of the bank.

56) Section 6.4.1.2 – Compliance with ARARs. As noted in earlier comments, the 0.1 foot limit with respect to flood elevation increases is not accurate.

57) Section 6.4.1.4 – Long-Term Effectiveness and Permanence. Alternative 2 (Removal). Page 83. Second paragraph. The last sentence in this paragraph should be clarified as follows (additional language in ***italic***

boldface): Long term bank monitoring and adaptive management is not required under this alternative *if the* ***high TEQ deposit is removed*** (or similar).

58) Section 7 - Response Proposal. Please see previous comments regarding the inadequacy of the RAOs.

59) Section 7.1 – Consistency with EPA's National Policy. Item 5. An additional sentence should be added that indicates: ***Also, monitoring and future residual risk assessment will inform the need for any necessary additional response activities (e.g., the identification of additional BMAs, etc.)***, or similar.

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